What is claimed is:

1. A method of detail enhancement for an original image signal represented by a set of pixels, the method comprising the steps of:

(a) detecting image pixels that belong to an image edge;

(b) for a detected pixel, generating an unsharp image signal at the detected pixel location;

(c) determining the difference between the original image signal and the unsharp signal, wherein said difference represents image details; and

(d) boosting the difference signal and adding the boosted signal to the original signal to obtain a detail enhanced image signal;

whereby boosting of any noise at the selected pixel location is reduced.

2. The method of claim 1 wherein in step (a) detecting image pixels that belong to an image edge, further includes the steps of detecting image pixels that belong to a horizontal or vertical image edge.

3. The method of claim 1 wherein in step (a) detecting image pixels that belong to an image edge, further includes the steps of detecting image pixels that belong to a noisy and sharp horizontal or vertical image edge.

4. The method of claim 1, wherein in step (b) generating an unsharp image signal further includes the steps of:

determining mean values of pixels in a two-dimensional window including the selected pixel; and

using said mean values in a filtering process to obtain an unsharp image signal at the selected pixel location.

5. The method of claim 1, where in step (a) detecting image pixels that belong to an image edge further includes the steps of:

selecting a pixel; and

based on the selected pixel and its neighboring pixels in a two-dimensional window, determining if the pixel belongs to an image edge;

wherein each pixel is checked separately to determine if it belongs to an image edge.

6. The method of claim 1, further comprising the steps of:

if a pixel is determined to belong to an image edge, then determining if the edge is noisy.

7. The method of claim 5, wherein detecting image pixels that belongs to an essentially vertical image edge further includes the steps of:

selecting at least W columns of pixels centered with the selected pixel, wherein each columns includes H pixels;

determining the mean value m of the pixels in each column, thereby generating W mean values;

determining the variance value σ of the pixels in each column, thereby generating W variance values; and

based on the W mean values and the W variance values, determining if the selected pixel belongs to a vertical image edge.

8. The method of claim 7, wherein:

the mean values m_j are determined according to the relation:

$$m_j = \frac{1}{H} \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} I_{i,j} \quad , \qquad j = -1,0,1 \, ,$$

the variance values σ_j are determined according to the relation:

$$\sigma_j = \frac{1}{H} \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} | I_{i,j} - m_j | \quad , \qquad j = -1,0,1, \, ,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

9. The method of claim 7, wherein the steps of detecting if the selected pixel belongs to an image edge, further includes the steps of:

determining if $| m_0 - m_j | > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$;

determining if $\max(| m_0 - m_1 |, | m_0 - m_{-1} |) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $| m_0 - m_j | > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$, and if $\max(| m_0 - m_1 |, | m_0 - m_{-1} |) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

10. The method of claim 7, further comprising the steps of:

if the selected pixel is determined to belong to an image edge, then determining if the edge is noisy.

11. The method of claim 10, wherein the step of checking if the edge is noisy further includes the steps of:

generating binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2}, \cdots, 0, \cdots, \frac{H-1}{2};$$

based on the binary pattern data, generating a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} | b_{i,0} - b_{i+1,0} |;$$

comparing the count N to a predetermined threshold value T_N, $0 < T_N < H-1$;

if the count N is not less than T_N, then the edge is considered as noisy.

12. The method of claim 10, wherein the step of checking if the edge is noisy further includes the steps of:

generating binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2}, \cdots, 0, \cdots, \frac{H-1}{2};$$

based on the binary pattern data, generating a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} (b_{i,0} \oplus b_{i+1,0});$$

comparing the count N to a predetermined threshold value T_N , $0 < T_N < H-1$;

if the count N is not less than T_N, then the edge is considered as noisy.

13. The method of claim 4, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

if the image edge direction is vertical:

determining the mean values further includes the step of determining the mean values of the pixels in

each column of the window, wherein there are a total of W_f such mean values;

performing the filtering process further includes the steps of using a low pass filter (LPF) on the mean values to obtain an unsharp image signal at the selected pixel location.

14. The method of claim 13, wherein performing the filtering process further includes the steps of:

selecting a one dimensional (1D) LPF, such that W_f is equal to the length of the LPF;

applying the LPF to the mean values to obtain the unsharp signal.

15. The method of claim 13, wherein performing the filtering process further includes the steps of:

selecting a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

generating a two-dimensional data array of the size W_f by H_f, wherein the data in each column of the

array are all set to the corresponding pixel mean value of the same column in the W_f by H_f window of neighboring pixels; and

applying the LPF to the array data to obtain the unsharp signal.

16. The method of claim 5, wherein detecting image pixels that belong to an essentially horizontal image edge further includes the steps of:

selecting at least H rows of pixels centered with the selected pixel, wherein each row includes W pixels;

determining the mean value of the pixels in each row, thereby generating H mean values;

determining the variance value of the pixels in each row, thereby generating H variance values;

based on the H mean values and the H variance values, determining if the selected pixel belongs to a horizontal image edge.

17. The method of claim 16, wherein:

the mean values m_i are determined according to the relation:

$$m_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} I_{i,j} \quad , \qquad i = -1,0,1 \ ,$$

the variance values σ_i are determined according to the relation:

$$\sigma_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} | I_{i,j} - m_i | \quad , \qquad i = -1,0,1,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

18. The method of claim 16, wherein the steps of detecting if the selected pixel belongs to an image edge, further includes the steps of:

determining if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$;

determining if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$, and if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

19. The method of claim 16, further comprising the steps of:

if the selected pixel is determined to belong to an image edge, then determining if the edge is noisy.

20. The method of claim 19, wherein the step of checking if the edge is noisy further includes the steps of:

generating binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2}, \cdots, 0, \cdots, \frac{W-1}{2};$$

based on the binary pattern data, generating a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} | b_{0,j} - b_{0,j+1} |;$$

comparing the count N to a predetermined threshold value T_N, $0 < T_N < W-1$;

if the count N is not less than T_N, then the edge is considered as noisy.

21. The method of claim 19, wherein the step of checking if the edge is noisy further includes the steps of:

generating binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2}, \cdots, 0, \cdots, \frac{W-1}{2} \text{ ;}$$

based on the binary pattern data, generating a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} (b_{0,j} \oplus b_{0,j+1}) \text{ ;}$$

comparing the count N to a predetermined threshold value T_N , $0 < T_N < W-1$;

if the count N is not less than T_N, then the edge is considered as noisy.

22. The method of claim 4, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

if the image edge direction is horizontal:

determining the mean values further includes the step of determining the mean values of the pixels in

each row of the window, wherein there are a total of H_f such mean values;

performing the filtering process further includes the steps of using a low pass filter (LPF) on the mean values to obtain an unsharp image signal at the selected pixel location.

23. The method of claim 22, wherein performing the filtering process further includes the steps of:

selecting a one dimensional (1D) LPF, such that H_f is equal to the length of the LPF;

applying the LPF to the mean values to obtain the unsharp signal.

24. The method of claim 22, wherein performing the filtering process further includes the steps of:

selecting a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

generating a two-dimensional data array of the size W_f by H_f, wherein the data in each row of the array

are all set to the corresponding pixel mean value of the same row in the W_f by H_f window of neighboring pixels; and

applying the LPF to the array data to obtain the unsharp signal.

25. The method of claim 1, further comprising the steps of, for a pixel that is not detected as belonging to an image edge in step (a):

performing a filtering process on the pixel to obtain an unsharp signal at that pixel location;

determining the difference between the original signal and the unsharp signal at the pixel location, wherein the difference represents image detail;

boosting the image detail, and adding the boosted image detail to the original image signal to obtain a detail enhanced image.

26. An image detail enhancement system for enhancing an original image signal represented by a set of pixels, comprising:

(a) a detector that detects image pixels that belong to an image edge; and

(b) an edge enhancer that, for a detected pixel, generates an unsharp image signal at the detected pixel

location, determines the difference between the original image signal and the unsharp signal, wherein said difference represents image details, boosts the difference signal and adds the boosted signal to the original signal to obtain a detail enhanced image signal, whereby boosting of any noise at the selected pixel location is reduced.

27. The system of claim 26 wherein the detector further detects image pixels that belong to a horizontal or vertical image edge.

28. The system of claim 26 wherein the detector further detects image pixels that belong to a noisy and sharp horizontal or vertical image edge.

29. The system of claim 26 wherein the edge enhancer further generates an unsharp image signal by determining mean values of pixels in a two-dimensional window including the selected pixel, and using said mean values in a filtering process to obtain the unsharp image signal at the selected pixel location.

30. The system of claim 26 wherein in detecting image pixels that belong to an image edge, the detector selects a

pixel and based on the selected pixel and its neighboring pixels in a two-dimensional window, determines if the pixel belongs to an image edge, wherein each pixel is checked separately to determine if it belongs to an image edge.

31. The system of claim 26 wherein if a pixel is determined to belong to an image edge, the detector further determining if the edge is noisy.

32. The system of claim 30, wherein to detect image pixels that belong to an essentially vertical image edge, the detector further:

selects at least W columns of pixels centered with the selected pixel, wherein each columns includes H pixels;

determines the mean value m of the pixels in each column, thereby generating W mean values;

determines the variance value σ of the pixels in each column, thereby generating W variance values; and

based on the W mean values and the W variance values, determines if the selected pixel belongs to a vertical image edge.

33. The system of claim 32, wherein:

the mean values m_j are determined according to the relation:

$$m_j = \frac{1}{H}\sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} I_{i,j} \quad , \qquad j=-1,0,1\,,$$

the variance values σ_j are determined according to the relation:

$$\sigma_j = \frac{1}{H}\sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} | I_{i,j} - m_j | \quad , \qquad j=-1,0,1,\,,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

34. The system of claim 32, wherein in detecting if the selected pixel belongs to an image edge, the detector further:

determines if $|m_0 - m_j| > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$;

determines if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $|m_0 - m_j| > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$, and if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

35. The system of claim 32, wherein if the selected pixel is determined to belong to an image edge, the detector further determines if the edge is noisy.

36. The system of claim 35, wherein in determining if the edge is noisy, the detector further:

generates binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2}, \cdots, 0, \cdots, \frac{H-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} |b_{i,0} - b_{i+1,0}|;$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < H-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

37. The system of claim 35, wherein in determining if the edge is noisy, the detector further:

generates binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2}, \cdots, 0, \cdots, \frac{H-1}{2}$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} (b_{i,0} \oplus b_{i+1,0});$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < H-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

38. The system of claim 29, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

if the image edge direction is vertical, the edge enhancer further:

determines the mean values of the pixels in each column of the window, wherein there are a total of W_f such mean values;

includes a low pass filter (LPF) that filters the mean values to obtain an unsharp image signal at the selected pixel location.

39. The system of claim 38, wherein the LPF comprises a one dimensional (1D) LPF, such that W_f is equal to the length of the LPF.

40. The system of claim 38, wherein:

the LPF comprises a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

the edge enhancer further generates a two-dimensional data array of the size W_f by H_f, wherein the data in each column of the array are all set to the corresponding pixel mean value of the same column in the W_f by H_f window of neighboring pixels; and

the data array is filtered by the LPF to obtain the unsharp signal.

41. The system of claim 30, wherein to detect image pixels that belong to an essentially horizontal image edge, the detector further:

selects at least H rows of pixels centered with the selected pixel, wherein each row includes W pixels;

determines the mean value of the pixels in each row, thereby generating H mean values;

determines the variance value of the pixels in each row, thereby generating H variance values;

based on the H mean values and the H variance values, determines if the selected pixel belongs to a horizontal image edge.

42. The system of claim 41, wherein:

the mean values m_i are determined according to the relation:

$$m_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} I_{i,j} \quad , \qquad i = -1,0,1 \, ,$$

the variance values σ_i are determined according to the relation:

$$\sigma_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} | I_{i,j} - m_i | \quad , \quad i = -1,0,1,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

43. The system of claim 41, wherein in detecting if the selected pixel belongs to an image edge, the detector further:

determines if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$;

determines if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$, and if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

44. The system of claim 41, wherein if the selected pixel is determined to belong to an image edge, the detector further determines if the edge is noisy.

45. The system of claim 44, wherein in detecting if the edge is noisy, the detector further:

generates binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2}, \cdots, 0, \cdots, \frac{W-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} | b_{0,j} - b_{0,j+1} |;$$

compares the count N to a predetermined threshold value T_N, $0 < T_N < W-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

46. The system of claim 44, wherein in detecting if the edge is noisy, the detector further:

generates binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2}, \cdots, 0, \cdots, \frac{W-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} (b_{0,j} \oplus b_{0,j+1}) ;$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < W-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

47. The system of claim 29, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

if the image edge direction is horizontal, the edge enhancer further:

determines the mean values of the pixels in each row of the window, wherein there are a total of H_f such mean values;

includes a low pass filter (LPF) for performing a filtering process on the mean values to obtain an unsharp image signal at the selected pixel location.

48. The system of claim 47, wherein the LPF comprises a one dimensional (1D) LPF, such that H_f is equal to the length of the LPF.

49. The system of claim 47, wherein:

the LPF comprises a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

the edge enhancer further generates a two-dimensional data array of the size W_f by H_f , wherein the data in each row of the array are all set to the corresponding pixel mean value of the same row in the W_f by H_f window of neighboring pixels; and

LPF filters the array data to obtain the unsharp signal.

50. The system of claim 26, further comprising a normal enhancer, wherein for a pixel that is not detected as belonging to an image edge, the normal enhancer performs a filtering process on the pixel to obtain an unsharp signal at that pixel location, determines the difference between the original signal and the unsharp signal at the pixel location, wherein the difference represents image detail, boosts the image detail and adds the boosted image detail to the original image signal to obtain a detail enhanced image.

51. An image detail enhancement system for enhancing an original image signal represented by a set of pixels, comprising:

(a) a detector that detects image pixels that belong to an image edge;

(b) an edge enhancer that, for a detected pixel, generates an unsharp image signal at the detected pixel location, determines the difference between the original image signal and the unsharp signal, wherein said difference represents image details, boosts the difference signal and adds the boosted signal to the original signal to obtain a detail enhanced image signal, whereby boosting of any noise at the selected pixel location is reduced; and

(c) a normal enhancer, wherein for a pixel that is not detected as belonging to an image edge, the normal enhancer performs a filtering process on the pixel to obtain an unsharp signal at that pixel location, determines the difference between the original signal and the unsharp signal at the pixel location, wherein the difference represents image detail, boosts the image detail and adds the boosted image detail to the original image signal to obtain a detail enhanced image;

wherein upon determining that an image pixel belongs to an image edge, the detector selects the edge enhancer to

enhance that image pixel, and upon determining that an image pixel does not belong to an image edge, the detector selects the normal enhancer to enhance that image pixel.

52. The system of claim 51 wherein the detector further detects image pixels that belong to a horizontal or vertical image edge.

53. The system of claim 51 wherein the detector further detects image pixels that belong to a noisy and sharp horizontal or vertical image edge.

54. The system of claim 51 wherein the edge enhancer further generates an unsharp image signal by determining mean values of pixels in a two-dimensional window including the selected pixel, and using said mean values in a filtering process to obtain the unsharp image signal at the selected pixel location.

55. The system of claim 51 wherein in detecting image pixels that belong to an image edge, the detector selects a pixel and based on the selected pixel and its neighboring pixels in a two-dimensional window, determines if the pixel

belongs to an image edge, wherein each pixel is checked separately to determine if it belongs to an image edge.

56. The system of claim 51 wherein if a pixel is determined to belong to an image edge, the detector further determining if the edge is noisy.

57. The system of claim 55, wherein to detect image pixels that belong to an essentially vertical image edge, the detector further:

selects at least W columns of pixels centered with the selected pixel, wherein each columns includes H pixels;

determines the mean value m of the pixels in each column, thereby generating W mean values;

determines the variance value σ of the pixels in each column, thereby generating W variance values; and

based on the W mean values and the W variance values, determines if the selected pixel belongs to a vertical image edge.

58. The system of claim 57, wherein:

the mean values m_j are determined according to the relation:

$$m_j = \frac{1}{H} \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} I_{i,j} \quad , \quad j = -1,0,1 \, ,$$

the variance values σ_j are determined according to the relation:

$$\sigma_j = \frac{1}{H} \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}} | I_{i,j} - m_j | \quad , \quad j = -1,0,1, \, ,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

59. The system of claim 57, wherein in detecting if the selected pixel belongs to an image edge, the detector further:

determines if $|m_0 - m_j| > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$;

determines if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $|m_0 - m_j| > \max(\sigma_0, \sigma_j)$, $j = -1 \text{ or } 1$, and if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

60. The system of claim 57, wherein if the selected pixel is determined to belong to an image edge, the detector further determines if the edge is noisy.

61. The system of claim 60, wherein in determining if the edge is noisy, the detector further:

generates binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2}, \cdots, 0, \cdots, \frac{H-1}{2} ;$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} | b_{i,0} - b_{i+1,0} |;$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < H-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

62. The system of claim 60, wherein in determining if the edge is noisy, the detector further:

generates binary pattern data b from pixels in column 0 of the window according to the relation:

$$b_{i,0} = \begin{cases} 0 & \text{if } I_{i,0} < m_0 \\ 1 & \text{if } I_{i,0} \geq m_0 \end{cases} \qquad i = -\frac{H-1}{2},\cdots,0,\cdots,\frac{H-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{i=-\frac{H-1}{2}}^{\frac{H-1}{2}-1} (b_{i,0} \oplus b_{i+1,0});$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < H-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

63. The system of claim 54, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

the edge enhancer includes a vertical edge enhancer, such that if the image edge direction is vertical, the detector selects the vertical edge enhancer such that the vertical edge enhancer:

determines the mean values of the pixels in each column of the window, wherein there are a total of W_f such mean values; and

includes a low pass filter (LPF) that filters the mean values to obtain an unsharp image signal at the selected pixel location.

64. The system of claim 63, wherein the LPF comprises a one dimensional (1D) LPF, such that W_f is equal to the length of the LPF.

65. The system of claim 63, wherein:

the LPF comprises a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

the vertical edge enhancer further generates a two-dimensional data array of the size W_f by H_f, wherein the data in each column of the array are all set to the corresponding pixel mean value of the same column in the W_f by H_f window of neighboring pixels; and

the data array is filtered by the LPF to obtain the unsharp signal.

66. The system of claim 55, wherein to detect image pixels that belong to an essentially horizontal image edge, the detector further:

selects at least H rows of pixels centered with the selected pixel, wherein each row includes W pixels;

determines the mean value of the pixels in each row, thereby generating H mean values;

determines the variance value of the pixels in each row, thereby generating H variance values;

based on the H mean values and the H variance values, determines if the selected pixel belongs to a horizontal image edge.

67. The system of claim 66, wherein:

the mean values m_i are determined according to the relation:

$$m_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} I_{i,j} \quad , \qquad i = -1,0,1 \, ,$$

the variance values σ_i are determined according to the relation:

$$\sigma_i = \frac{1}{W} \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}} | I_{i,j} - m_i | \quad , \quad i = -1,0,1,$$

where $I_{i,j}$ is the value of a pixel located at row i and column j in the window, such that the row and column index of the selected pixel is 0.

68. The system of claim 66, wherein in detecting if the selected pixel belongs to an image edge, the detector further:

determines if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$;

determines if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$;

where T_m is a predetermined threshold value;

such that if $|m_0 - m_i| > \max(\sigma_0, \sigma_i)$, $i = -1 \text{ or } 1$, and if $\max(|m_0 - m_1|, |m_0 - m_{-1}|) \geq T_m$, then the selected pixel is considered as a pixel in an image edge.

69. The system of claim 66, wherein if the selected pixel is determined to belong to an image edge, the detector further determines if the edge is noisy.

70. The system of claim 69, wherein in detecting if the edge is noisy, the detector further:

generates binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2},\cdots,0,\cdots,\frac{W-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} | b_{0,j} - b_{0,j+1} |;$$

compares the count N to a predetermined threshold value T_N, $0 < T_N < W-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

71. The system of claim 69, wherein in detecting if the edge is noisy, the detector further:

generates binary pattern data b from pixels in row 0 of the window according to the relation:

$$b_{0,j} = \begin{cases} 0 & \text{if } I_{0,j} < m_0 \\ 1 & \text{if } I_{0,j} \geq m_0 \end{cases} \qquad j = -\frac{W-1}{2},\cdots,0,\cdots,\frac{W-1}{2};$$

based on the binary pattern data, generates a count N of the number of neighboring binary pattern data that vary from each other according to the relation:

$$N = \sum_{j=-\frac{W-1}{2}}^{\frac{W-1}{2}-1} (b_{0,j} \oplus b_{0,j+1}) \; ;$$

compares the count N to a predetermined threshold value T_N , $0 < T_N < W-1$;

wherein if the count N is not less than T_N, then the edge is considered as noisy.

72. The system of claim 54, wherein:

said window comprises a W_f by H_f rectangular window centered with the selected pixel;

the edge enhancer includes a horizontal edge enhancer, wherein if the image edge direction is horizontal, the detector selects the horizontal edge enhancer such that the horizontal edge enhancer:

determines the mean values of the pixels in each row of the window, wherein there are a total of H_f such mean values; and

includes a low pass filter (LPF) for performing a filtering process on the mean values to obtain an unsharp image signal at the selected pixel location.

73. The system of claim 72, wherein the LPF comprises a one dimensional (1D) LPF, such that H_f is equal to the length of the LPF.

74. The system of claim 72, wherein:

the LPF comprises a two dimensional (2D) LPF, such that W_f and H_f are equal to the horizontal and vertical length of the LPF, respectively;

the horizontal edge enhancer further generates a two-dimensional data array of the size W_f by H_f , wherein the data in each row of the array are all set to the corresponding pixel mean value of the same row in the W_f by H_f window of neighboring pixels; and

LPF filters the array data to obtain the unsharp signal.